## Time : Three Hours

P. Pages: 4

## Notes : 1. All questions carry equal marks.

- 2. Assume suitable data wherever necessary.
- 3. Illustrate your answers wherever necessary with the help of neat sketches.
- 4. Use of non programmable calculator is allowed.
- 1. a) Find analytically the reaction at support A & B of the frame structure loaded as shown in fig. 8



b) Two identical rollers each weighing 100 N are supported by an inclined plane as shown in figure. Find reactions at A, B & C.

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- **2.** a) Explain the resolution of force into force and a couple.
  - b) The triangular plate ABC shown in figure carries a load of 2000 N applied at E. and is supported in a horizontal position by three vertical cables attached at A, B & C. Compute the tension in each cable.



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Max. Marks : 80

- **3.** a) Explain why the members of a pin jointed truss are subjected to axial forces only.
  - b) For the truss shown in figure, Find support reactions and force in member CJ.



OR

- **4.** a) Write short notes on reversible machine.
  - b) Derive the belt friction relation
    - $\frac{T_1}{T_2} = e^{\mu\theta}$
  - c) A tape is threaded over a three pulleys as shown in Figure. If P = 10 N and  $\mu = 0.20$  between the tape and each pulley. Find the force P required to move the tape rightward.



**5.** a) Using the virtual work method Find the reactions at support A of the compound beam shown in figure. B and C are the hinged supports where as A and B are the roller supprts.



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b) The parallelogram linkage shown in figure carries a force P, F & Q applied at the mid points of the link for a given value of Q. Determine the force Q interms of P & F that will maintain the equilibrium of linkage.



OR

- **6.** a) Determine moment of inertia for the given lamina.
  - 1) Wrt specified reference axis 1) and 2)
  - 2) Wrt centroidal axis.



- b) Determine product of inertia of the figure.
  - 1) Wrt specified reference axis
  - 2) Wrt centroidal axis



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7. a) The a - t curves for a particle having rectilinear motion is shown at t = 0 and initial vel is 1.5 m/sec and particle is 10 m left of the origin of displacement. Draw the v - t & s - t curves.



- b) A particle is projected at an angle of 60° with the horizontal. The horizontal range of particle is 6000m.
  - Find i) The velocity of projection
    - ii) The maximum height attained by the projectile

## OR

- 8. a) The velocity of a particle moving along x axis is defined by  $v = Kx^3 4x^2 + 6x$ , where v is m/sec, x in meter & K is constant. If K=1 compute the value of acceleration when x = 2 m.
  - b) If position vector of a particle is defined by  $\bar{r} = (2t^3 12t)i + (6t^2)j$ , where r is in m and t is in sec. Find the Principle radius of curvature of the path of particle at t = 2sec.
- **9.** a) Determine the acceleration of body A as shown in figure, assuming the pulleys to be **12** frictionless & of negligible weight.



b) Explain D'Alembert's principle.

## OR

- **10.** a) What is the 'Elastic impact'?
  - b) Three balls A, B, C of weight 20N, 40N & 80 N are moving in the same direction with velocities 10 m/sec, 4 m/sec & 2 m/sec respectively. If ball A strikes with the ball B which in turns strike with Ball C. Take e = 0.8 Find i) velocities of ball after impact ii) Loss of KE during impact.

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